

INSTRUCTION MANUAL

BLACKHAWK SERIES BROADBAND POWER SUPPLIES



Installation and Operation Manual

Manual Part No:
017-027-B0
Issue 01 (01/23/06)

Documented Power Supply Models

The following power supply models, with their part numbers, are documented by this instruction manual. For available options, refer to the **OPTIONS** section of this manual.

600 VA OUTPUT RATING

<u>MODEL NUMBER</u>	<u>PART NUMBER</u>	<u>INPUTS</u>
600-120/60-36	017-027-20	120VAC, 60Hz, 3-Battery
600-120/60-48	017-027-21	120VAC, 60 Hz, 4-Battery
600-240/60-36	017-027-22	240VAC, 60Hz, 3-Battery
600-240/60-48	017-027-23	240VAC, 60Hz, 4-Battery
600-100/50-36	017-031-23	100VAC, 50Hz, 3-Battery
600-100/50-48	017-031-21	100VAC, 50Hz, 4-Battery
600-200/50-36	017-034-20	200VAC, 50Hz, 3-Battery
600-200/50-48	017-034-21	200VAC, 50Hz, 4-Battery

900 VA OUTPUT RATING

<u>MODEL NUMBER</u>	<u>PART NUMBER</u>	<u>INPUTS</u>
900-120/60-36	017-028-20	120VAC, 60Hz, 3-Battery
900-120/60-48	017-028-21	120VAC, 60 Hz, 4-Battery
900-240/60-36	017-028-22	240VAC, 60Hz, 3-Battery
900-240/60-48	017-028-23	240VAC, 60Hz, 4-Battery
900-100/50-36	017-032-20	100VAC, 50Hz, 3-Battery
900-100/50-48	017-032-21	100VAC, 50Hz, 4-Battery
900-200/50-36	017-035-20	200VAC, 50Hz, 3-Battery
900-200/50-48	017-035-21	200VAC, 50Hz, 3-Battery

1350 VA OUTPUT RATING

<u>MODEL NUMBER</u>	<u>PART NUMBER</u>	<u>INPUTS</u>
1350-120/60-36	017-030-20	120VAC, 60Hz, 3-Battery
1350-120/60-48	017-030-21	120VAC, 60Hz, 4-Battery
1350-240/60-36	017-030-22	240VAC, 60Hz, 3-Battery
1350-240/60-48	017-030-23	240VAC, 60Hz, 4-Battery
1350-100/50-36	017-033-20	100VAC, 50Hz, 3-Battery
1350-100/50-48	017-033-21	100VAC, 50Hz, 4-Battery
1350-200/50-36	017-036-20	200VAC, 50Hz, 3-Battery
1350-200/50-48	017-036-21	200VAC, 50Hz, 3-Battery

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EMI / RFI STATEMENT

This device has been designed and manufactured to comply with the limits for a Class A digital device pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference when this equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed in accordance with this instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area may cause interference that the cable provider must correct at its own expense.

Section 1: Critical Safety Issues

SAFETY ADMONISHMENTS:

Three different levels of safety admonishments are used within this instruction manual; specifically **DANGER**, **WARNING**, and **CAUTION**.

The statement following the **DANGER** heading alerts the equipment user of a potentially life- or health-threatening situation unless precautions are taken against it. Admonishments of this nature usually entail the hazards of electrical shock or other such related hazards.

The statement following the **WARNING** heading alerts the equipment user of a condition or procedure that could result in interruption of service. While this condition may only be a nuisance in video-only services, it may prove to be more serious when telephony, VoIP or data transfer services are being provided.

The statement following the **CAUTION** heading alerts the equipment user of a condition that could result in damage to the subject equipment or ancillary equipment if care is not exercised during certain maintenance or operating procedures.

SAVE THESE INSTRUCTIONS FOR FUTURE REFERENCE

Emergency Shutdown Procedure

DANGER

Exercise extreme caution when performing the following procedure. Carry out the steps precisely in the order given to avoid the possibility of personal injury or equipment damage.

Perform the following procedure if the power supply must be shut down and disconnected on an emergency basis:

1. Switch the BATTERY CIRCUIT breaker to the OFF position.
2. Disconnect the AC power cord from the outlet in the cabinet.
3. Remove the BATTERY connector from its location at the power supply front panel.
4. Disconnect the output cable from the OUTPUT connector at the power supply front panel.
5. Within the service entrance box or branch circuit box, operate the AC input circuit breaker for the power supply to the OFF position.

General Safety Issues

The power supply documented in these instructions has been designed, tested and produced to ensure safe, trouble-free operation. Personnel using or installing this power supply should completely read and fully understand the following safety instructions. They are provided here as informational guidelines for your continued safety in usage of the product. These general safety issues should be observed in all phases of power supply installation and service.

This power supply uses two sources of electrical power: commercial AC and DC derived from a battery. Whenever performing maintenance on any of the internal components, you **must** disconnect both the battery cable and AC line cord.

Always use proper lifting techniques when handling the power supply or batteries. Both the power supply and a single 12-volt battery weigh approximately the same, about 65 pounds (30 Kg).

Personnel installing or servicing batteries must wear eye protection (goggles or full face shield) and protective clothing (apron and gloves) as mandated by standard operating procedures. Additionally, only fully insulated tools specifically designed for battery installation and service should be used for that purpose. Tools wrapped with vinyl or fabric-based electrical tape are NOT acceptable substitutes.

Safety Issues of Power Supply Installation and Use

The subject power supply has been designed and built to power CATV and broadband distribution equipment only. It is not intended for any other usage and provides output voltages suitable only for its intended application.

Power supplies documented in this instruction manual use more than one source of power. If any reason exists to open the power supply enclosure for maintenance or adjustments, first turn off the BATTERY CIRCUIT breaker on the front panel, disconnect the AC line cord from its outlet and remove the BATTERY connector from its receptacle on the front panel. Be certain that at least **5 minutes** has elapsed before opening covers after disconnecting operational power.

DANGER

This power supply operates from either a 120 volt or 240 volt AC source and produces internal voltages in excess of 500 volts. DO NOT open any covers or panels or attempt to perform any service to the power supply without first removing and disconnecting all external AC and DC power sources. Only trained, qualified personnel should attempt service and repair work on the power supply.

Install only gelled electrolyte valve regulated lead acid (VRLA) or AGM type batteries as a standby DC source for this power supply. See the following Battery Safety Issues for further information.

The power supply must be installed within a cabinet suitable for accommodating CATV power supplies. If installed outdoors, the cabinet must have a 3R (rainproof) rating as a minimum requirement. See the following Enclosure Safety Issues for further information.

Enclosure Safety Issues

The cabinet and the power supply must be installed by qualified technicians or installers only. Whether using ground-mount or pole-mount option, appropriate mounting hardware meeting local codes and construction practices must be used. Failure of fasteners over the service life of the cabinet may result in hazardous conditions for the general public who may pass near the installation.

The outer cabinet housing the power supply must be of adequate strength to support the power supply and its associated batteries. Additionally, the cabinet must afford adequate ventilation for the power supply such that a minimum free air space of 2-inches remains around all sides and the top of the power supply. Air intake at the front of the inverter module must remain unobstructed.

Temperature of the air entering the inverter module and flowing around the power supply must not exceed 60 degrees Celsius. Air intake and exhaust openings within the outer cabinet must not be less than 40 square inches in area. If these limits are exceeded or

cannot be attained, a suitable forced-air cooling system may be required within the cabinet.

Battery Safety Issues

When installing batteries for the power supply, do not mix battery types (gelled electrolyte and AGM) in the same string or within the same cabinet. **DO NOT** use flooded type batteries with liquid electrolyte with the power supply under any circumstances. Such batteries are hazardous to use within broadband cabinets and can degrade or destroy equipment installed in the cabinet with them. Use only gelled electrolyte or AGM batteries of suitable size, voltage and capacity for use in a CATV system.

DANGER

Batteries can supply extremely large currents for a short period of time, sufficient to vaporize or melt metal objects. For this reason, installers must remove watches, rings and other jewelry before placing or connecting batteries in the the cabinet. Insulating gloves and protective clothing should be worn during battery installation, consistent with local practices.

Batteries contain sulphuric acid in gelled or semi-liquid form. Direct contact with any spilled electrolyte from a damaged battery may result in skin irritation or chemical burns. For this reason, handle batteries carefully to avoid puncturing the case and releasing any of the electrolyte. In case of contact with the electrolyte, thoroughly wash any contaminated areas of the skin with soap and water. In case of contact with the eyes, immediately flush with copious amounts of water and seek medical attention. Minor surface spills can be neutralized with an appropriate neutralizing agent such as bicarbonate of soda (baking soda).

Always use proper lifting techniques when handling batteries. Each 12-volt battery weighs approximately 65 pounds (30 Kg).

Personnel installing or servicing batteries must wear eye protection (goggles or full face shield) and protective clothing (apron and gloves) if necessary, according to local practices. Additionally, only fully insulated tools specifically designed for battery installation and service should be used for that purpose. Tools wrapped with vinyl or fabric-based electrical tape are NOT acceptable substitutes.

The BATTERY CIRCUIT breaker on the front panel of the power supply must be operated to the OFF position before installing, changing and connecting batteries.

Verify correct battery polarity and voltage at the DC input connector of the power supply before closing the BATTERY CIRCUIT breaker. Applying DC input of improper polarity or voltage can seriously damage or entirely destroy the power supply.

Replace any battery that is found to have a swollen or cracked case. Always recycle used batteries to reclaim lead and other materials that can pose environmental hazards if disposed of improperly.

Section 2: Introduction

Blackhawk Series Product Overview

The MultiPower Blackhawk Series power supplies provide filtered and regulated AC output power of proper voltage and current values to operate amplifiers, nodes and other active devices in CATV and broadband networks. These supplies are designed to normally power the network from the commercial AC line while maintaining an emergency battery in a state of full charge. If the commercial AC line fails for any reason or if line voltage exceeds preset low or high limits, the low voltage inverter within the power supply immediately begins providing power to the network load while drawing its operating power from the battery. After commercial AC line power has been restored, the power supply will revert to its normal operating mode supplying power to the network load while drawing operational power from the commercial AC line. Simultaneously, the internal battery charger within the power supply will recharge the battery. The power supply will continue providing filtered and regulated AC to the network load.

All Blackhawk Series power supplies operate as standby units, transferring between power sources (AC line and inverter) in less than one cycle of power. Inverter transfer from line mode to battery mode and from battery mode to line mode is synchronous resulting in minimum load power anomalies. Refer to Fig. 2-1 for a typical output power wave-form during transfer from commercial line to inverter power.

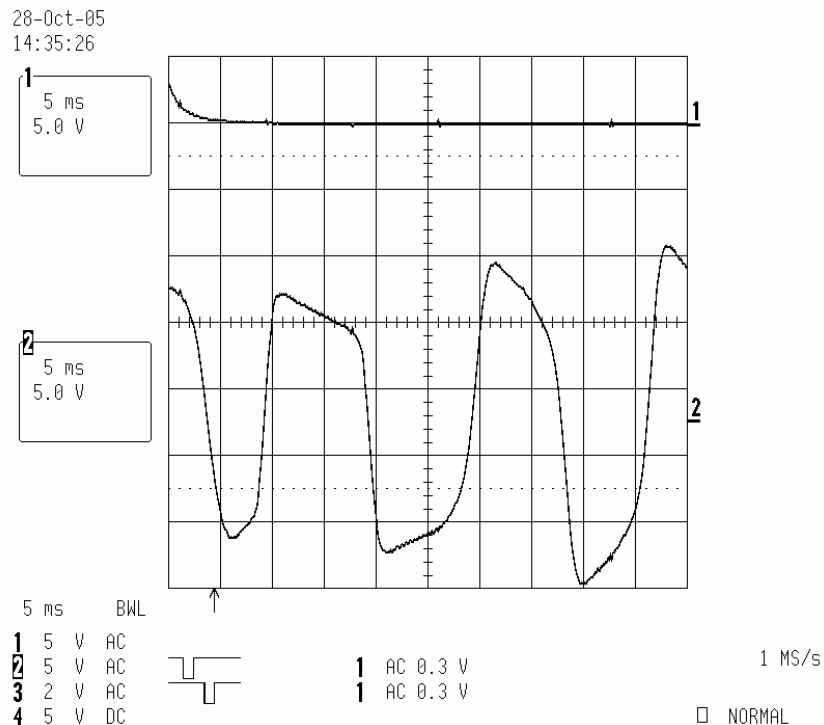


Fig. 2-1 Typical Output Transfer Waveform: Nominal 90 Volt Output, 80% Load

As shown in Fig. 2-1, output voltage never decreases below 90% of full output rating during the source transfer. Output voltage recovers to full rated output within 2 cycles following transfer. Under the test conditions in which the waveform was recorded, output voltage was measured to be 86.30 volts RMS with 80% of full rated load applied.

Video-only services using equipment powered by standby power supplies should exhibit little if any disturbance within the customers' homes during a source transfer. On the other hand, critical services such as VoIP, telephony grade communications and data transfer may experience undesired disturbances from source transfers between commercial AC line and inverter power. Such services may be highly intolerant of any power anomalies, even minor disturbances that would never be noticed on video-only services. For mission-critical services requiring an exceptionally high degree of power integrity, system operators are advised to consider using one of the MP Plus Series true-UPS power supplies offered by Multilink Broadband. Contact your local Multilink sales representative for further information.

The power supplies documented in this instruction manual have been designed to support optional HMS status monitoring. The HMS protocol supports communication between the power supply and the monitoring device via an RS-485 serial port in an external modem. HMS status monitoring may be installed either at the factory or in the field as an added option.

Blackhawk Series Product Features:

- 60/75/90 VAC output operation; easily user selectable.
- Serial status monitoring available, compatible with HMS-022 protocol.
- High efficiency for economical line operation and longer standby run time.
- Ferroresonant output: filters and regulates load power.
- *Status at a glance* display.
- High input power factor, typically 0.9 or better (line mode).
- Temperature compensated charger with battery temperature sensor.
- Robust inverter circuits with compact forced-air cooling.
- PM (pole-mount) and GM (ground-mount) enclosure options.

Unpacking and Inspection

Before installing this equipment, inspect the power supply for shipping damage or missing components. If the power supply or other items were damaged in shipment, file a damage claim with the shipping company and contact your Multilink Broadband representative immediately. Be sure to retain the original shipping carton and all packing material for the power supply until you are certain that warranty return will not be required.

All Blackhawk Series power supplies include:

- Power supply, ready for installation in cabinet
- Battery temperature sensor cable
- Installation and operating instructions

Missing or Damaged Items

If items are found to be damaged or missing, contact the shipping company and your Multilink Broadband representative immediately. All damage claims must be filed with the shipping company conveying your equipment. Your Multilink Broadband representative will be able to assist with immediate equipment needs if necessary.

Original Shipping Container

When returning a unit for service, use its original shipping container and all original packing materials. Items damaged as a result of improper packaging will not be covered under provisions of warranty service.

Other Items

If you ordered other items such as batteries and cable kits for use with the power supply, ensure also that those items did not sustain shipping damage. As with the power supply itself, all damage claims must be filed with the shipping company and your Multilink Broadband representative should be contacted immediately.

Section 3: Cabinet Installation

DANGER

Installers must exercise extreme caution during installation of a pole-mounted cabinet. Overhead utility lines present an immediate danger to all workers since contact with a primary utility line will result in serious injury or death.

The following procedure is intended as a **general guideline only** for mounting a cabinet on a utility pole. Actual mounting methods used will be dictated by local codes and requirements of the utility having ownership of the pole. Alternate mounting methods (such as straps) may be employed on steel or concrete poles; however, extra care in the selection of hardware for these mounting schemes will be required. All local codes and standards for construction techniques must be observed when planning and executing a pole-mount installation.

The following requirements should be noted before commencing installation activities:

Local codes may require that a service disconnect switch equipped with overcurrent protection be installed between the power supply and the utility. The utility power

conductors shall be connected to the power supply through an appropriate service entrance equipment.

Permission to mount the UPS on the utility pole shall be gained in accordance with agreements between the cable company and the utility company.

A bucket truck and other suitable equipment, including climbing spikes and safety harness will be required.

General Installation Procedure: Pole Mounted Cabinet

1. Using the pole mount “U” bracket as a template, drill 2 holes completely through the pole. The diameter of the hole will depend on the hardware used, but should be slightly oversized to allow for hole drift and bracket alignment. The “U” bracket will accommodate bolts up to 5/8-inch in diameter.
2. Observe the location of the retaining hardware to lock the “U” bracket to the cabinet back. The holes must line up to allow the locking bolt to pass through the pole “U” bracket and cabinet bracket to prevent the cabinet from being catastrophically dislodged from the pole if it is struck.
3. Mount the “U” bracket to the pole using appropriate mounting hardware and through-bolts.
4. Tighten the through-bolts securely but not so snugly as to deform the “U” bracket. If the “U” bracket is deformed, it will be impossible to engage the mating bracket on the back of the cabinet.
5. Slide the locking bolt through the “U” bracket and the mating bracket on the rear of the cabinet. Install the nut and tighten securely. This bolt is important since it prevents the cabinet from being dislodged from the pole if a vehicle or other massive object impacts the base of the pole.
6. Run necessary electrical wiring to the service entrance box on the enclosure. Observe all national and local electrical codes. A licensed electrician must perform this step, and the proper authorities must inspect the resulting work.
7. Connect the CATV power feed coax to the output fitting on the cabinet. In some cases it will be necessary to terminate the coax with a pin type connector with the “stinger” (inner conductor of the hard line) trimmed to ½- inch beyond the threaded portion of the connector body. A right angle connector may be required, depending on specific installation conditions at the site.
8. Recheck all mounting hardware for tightness and integrity. Recheck all wiring.
9. Install the power supply and batteries in the cabinet as outlined in this manual.

General Installation Procedure: Ground Mounted Cabinet

The following procedure is intended as a **general guideline only** for ground-mounting a cabinet on a pad or pedestal. Actual mounting methods used will be dictated by local codes and requirements. All local codes and standards for construction techniques must be observed when planning and executing a cabinet installation.

The following requirements should be noted before commencing installation activities:

Obtain any and all necessary permits and easements before pouring any concrete or installing the cabinet. Permission to mount the UPS shall be obtained in accordance with agreements between the cable company, the utility company, and any government entity or body having jurisdiction.

INSTALLATION NOTE: Tighten all mounting hardware securely before installing the UPS and batteries into the cabinet. Failure to do so may result in the cabinet flipping over and causing severe injury to the installer.

For maximum strength and security, use a poured-concrete pad. The mounting bolts should be 7/16-inch in diameter and cast in the concrete whenever possible. Make a suitable template of the pedestal skirt for mounting bolt placement.

Local codes may require that a service disconnect switch equipped with overcurrent protection be installed between the power supply and the utility. The utility power conductors shall be connected to the power supply through an appropriate service entrance equipment.

1. Be certain the intended mounting surface, either poured concrete or pre-cast, is level and square and that all necessary power and coaxial connections are stubbed up correctly.
2. Install the cabinet over the mounting bolts and secure to the pad with the appropriate hardware. Tighten all hardware securely.
3. Connect electrical wiring in the service entrance box as necessary. Observe all national and local electrical codes. A licensed electrician must perform this step, and the proper authorities must inspect the resulting work.
4. Connect the CATV power feed coax to the output fitting on the cabinet. This connector may be internal to the cabinet depending on the installation. In some cases it will be necessary to terminate the coax with a pin type connector with the "stinger" (inner conductor of the hard line) trimmed to ½- inch beyond the threaded portion of the connector body. A right angle connector may be required, depending on specific installation conditions at the site.

5. **INSTALLATION NOTE:** Do not install batteries until verifying that the cabinet mounting hardware is secure. Failure to do so may result in the cabinet flipping over, causing severe injury to the installer.
6. Install the power supply and batteries in the cabinet as outlined in this manual.

Section 4: Front Panel Controls, Connections and Indicators

The front panel of the power supply contains various connectors, indicators and all operator controls. These items are described as follows.

Controls

Circuit Breakers: Input and output circuit breakers are described as follows:

- a) Output Circuit Breaker: This 20-amp circuit breaker, located at the left side of the front panel, protects the power supply in case a fault condition occurs on the output circuit. This circuit breaker is a push-to-reset device.
- b) Battery Circuit Breaker: 80 amp circuit breaker protects battery circuit and input wiring. This circuit breaker is also used as a DC switch to apply and remove battery power to the power supply.

Switches: One pushbutton switch controls functions within the power supply:

TEST Switch: This switch, located below the indicator LEDs on the front panel of the inverter module, initiates and cancels local battery test.

Connections:

Output Connectors:

The Blackhawk Series power supplies contain one power output connector, located in the lower left corner of the front panel. The mating Anderson mini-power pole connector provides the means for connecting output power to the appropriate network power connector in the cabinet. The black connector is hot; the white connector is ground return for the output.

BATTERY: Anderson-type connector: used for connecting the external battery to the power supply.

BATTERY TEMP SENSOR: Mini Mate-N-Lok: connects the external temperature probe for temperature compensated battery charging.

CABINET INDICATORS: Mini Mate-N-Lok: connects the enclosure alarm and status lamps to the power supply for external status indication. The power supply will activate an external green lamp to indicate normal operation or will activate a red alarm lamp to indicate battery operation or a failure condition in need of correction.

Indicators:

A group of light emitting diodes (LEDs) on the front of the inverter module provides visual indication of power supply operational status. These LEDs are described as follows:

Power Supply Status Indicators: The LEDs on the inverter module front panel form the *Status At A Glance* display that indicates operational status of the power supply circuits. Under normal operating conditions with line power applied and the battery fully charged, all LEDs with the exception of the TEST indicator should illuminate green. Any alarm or abnormal operating condition will result in one or more LEDs illuminating either amber or red.

Any indicator of a color other than green will be easily noticed so operating or service technicians will be able to discern, at a glance, the operational status of the power supply. Indicators and their operational states are described as follows:

LINE: AC input LED indicates one of three status conditions:

- Green: line power available and within acceptable limits
- Amber: qualifying line following restoration
- Red: line power low in voltage or completely failed

BATTERY: Battery LED indicates one of three states:

- Green: Battery fully charged, voltage normal
- Amber: Battery charger is operating in the high rate mode
- Red: Alarm; battery is discharging or low battery cutoff point attained

SENSOR: This LED indicates status of the temperature probe:

- Green: Probe connected and operating normally
- Not illuminated: Alarm; probe has become disconnected or has failed

TEST: This indicator operates in conjunction with the remote/local battery test function.

Testing may be initiated locally by actuating the TEST switch or remotely by issuing appropriate commands via the status monitor port. This LED indicates the following operational states:

- Green: Testing locally by actuating the TEST switch
- Amber: Flashes when serial data is being sent to the transponder
- Red: Alarm; check battery for state-of-charge or failure condition

Section 5: Installation and Setup

Installing and wiring any model within the Blackhawk Series power supplies into an enclosure may be accomplished as simply as connecting input and output wiring to the appropriate connectors of the power supply. If wired for 120 volt AC input, the AC power cord of the power supply mates with a standard 5-20R 120 volt, 20 amp outlet. The 230/240 volt version of the power supply requires a standard 6-15R AC outlet. All other connectors on the front panels of the modules mate with industry-standard connectors widely available and used within the CATV industry. Moreover, connectors used in this power supply mate with accessory harnesses and assemblies designed and manufactured by Multilink Broadband. Refer to the *OPTIONS* section of these instructions for further information.

This power supply is designed for use in both existing and new enclosures of either pole or ground-mount configuration. Observe the following procedures during installation of any Blackhawk Series power supply.

Preparation:

The Blackhawk Series power supplies have been factory assembled, tested and prepared as a complete product ready for installation within an enclosure. The installer must verify that the correct type of AC power receptacle is installed in the enclosure for the input service and power supply selected for use at any given site. Additionally, the correct battery must be installed in the enclosure since the power supplies are fabricated and adjusted for 36 or 48 volt DC input, exclusively. Power supply ratings may be verified from the nameplate on the left side panel near the power cord.

- 1) Check to ensure that the correct system output voltage has been selected. The output voltage select terminal board is located behind the left-side front panel, allowing the user to choose output voltage of 60, 75 or 90 volts. If the output voltage must be changed from its factory setting, refer to the *SERVICE* section of these instructions for VOLTAGE RECONFIGURATION.
- 2) Additionally, verify that the correct battery string has been installed in the enclosure for 36 or 48 volt battery input. Check the nameplate of the power supply or the interior of the inverter module to determine that the DC input voltage requirements match the configuration of the system.

Placement in the Enclosure:

This power supply has been designed primarily for use within a cabinet or enclosure offering protection from outdoor weather, entry of excessive dust, dirt or moisture and from unauthorized contact by untrained personnel. If used in a controlled environment, the power supply may be located within an indoor equipment cabinet or may be mounted on a rack shelf.

The power supply should be mounted on a ventilated shelf that allows free air circulation, especially through the front and rear panels on the right side of the power supply. Clearance of at least 2-inches for unobstructed air flow must be maintained around all surfaces of this power supply. Temperature of the air entering the power supply should not exceed 50 degrees C (122 degrees F).

Wiring:

Connect input, output, control and monitor wiring to the power supply according to the following procedure. Refer to Fig. 5-1 for control and connector positions.



Fig. 5-1 Power Supply Front Panel

- 1) Operate the AC line circuit breaker in the service entrance box to the OFF position. If the power supply is located at a head end or other customer premise site, ensure that the branch circuit breaker chosen to protect the AC receptacle for the power supply is operated to the OFF position.
- 2) Operate the BATTERY CIRCUIT BREAKER on the front panel of the inverter module to the OFF (0) position.
- 3) Apply the system load to the OUTPUT connector on the front panel of the power supply. Do not attempt to load the power supply to a level greater than its total rated output of 600, 900 or 1350 VA, depending on the model being used. Long-term overloads can permanently damage your power supply.

- 4) Connect the AC line cord from the power supply to the appropriate AC receptacle.
- 5) Insert the battery plug from the battery wiring harness into the mating BATTERY receptacle on the front panel of the inverter module.
- 6) Insert the temperature sensor plug into the mating TEMP SENSOR receptacle on the front panel of the inverter module. The body of the temperature sensor probe should be placed between two of the battery cases in the enclosure.
- 7) If the indicator light option has been provided with the enclosure, the plug on the indicator wire harness should be inserted into the CABINET INDICATORS receptacle.
- 8) Alarm monitoring and serial status reporting may be implemented if optional alarm and serial communications firmware and hardware have been installed in the power supply. Refer to the OPTIONS section of this manual for further information.

Initial installation and wiring is now complete.

Battery Placement and Wiring:

Proper installation and wiring of the batteries is critical to the long-term backup capability of any power supply system. Gelled electrolyte, valve regulated batteries are recommended for use in outdoor cable TV / broadband UPS and power supply applications. All batteries should be tested and fully charged prior to installation.

In light of the specialized handling and connection requirements for batteries, only trained personnel should install batteries in an enclosure. Personnel must always employ appropriate safety equipment (goggles or face shields, insulated gloves, etc.) and only use fully insulated tools for tightening hardware on the battery terminals. Additionally, proper lifting tools and techniques must always be used during battery installation to avoid personal injury or equipment damage.

Care and Feeding of Batteries: Once installed and connected, batteries must not be allowed to sit idle without receiving a charge. The power supply must be started, even if at minimum load, and allowed to charge the batteries. Initial charging to ensure full reserve time may require as long as seven days to accomplish. Batteries connected to an idle system without receiving a charge can be irreparably damaged, thereby requiring replacement before the system can be fully commissioned into service.

The charging requirement becomes a special consideration when the accessory Battery Balance Manager is integrated into the cabinet installation. The BBM Plus product may be connected **only** when the power supply is fully operational and capable of charging the battery.

Battery Installation Procedure:

1. Place the batteries on the lower shelf of the enclosure, positive terminal facing out.
2. Route the terminal connector ends of the battery cable from the power supply compartment at the top of the enclosure to the battery compartment.
3. Wire the batteries in series, connecting negative post of one battery to positive post of the next. Battery cables and terminals are color coded to aid in correct wiring. Black terminal is negative (-); red terminal is positive(+).
4. After completing all connections to the battery terminals, use a digital multimeter (DMM) to verify proper voltage and polarity at the battery cable connector that terminates to the power supply DC input port. For 3-battery systems, indicated voltage should be approximately 36 volts or slightly higher. In a 4-battery system, indicated voltage should be approximately 48 volts or slightly higher. When the red and black meter probes are connected to the corresponding colored terminals of the battery harness connector, the meter should indicate positive (+) voltage, assuming proper connections at the meter itself.

WARNING

If voltage and polarity indications do not correspond to those described above, determine the cause before mating the battery connector to the power supply. Incorrectly wired batteries can cause personal injury or permanent damage to equipment.

5. Space the batteries approximately 1 inch apart to provide adequate airflow.
6. Attach the body of the temperature sensor probe to the side of the center battery using self-adhesive tape rated for use in wide temperature ranges. Depending upon battery construction, it may be necessary to hang the sensor in close proximity to the side of the battery instead of attaching it directly.

Section 6: Startup and Operation

The power supply is ready to be placed into operation after it has been installed in its enclosure and all input and output connections have been made,. Ensure that AC input power is available to the power supply receptacle then perform the following steps in sequence.

CAUTION

The following steps in the startup procedure MUST be performed exactly as presented; otherwise, permanent damage to the power supply may result. Observe the status of the LED indicators as a guide in performing the startup procedure.

1. Ensure that the BATTERY CIRCUIT BREAKER has been operated to the OFF (0) position. All connections and initial wiring must be in place as previously outlined and described.
2. Operate the utility AC circuit breaker in the service entrance box to the ON position. The power supply should start and immediately begin delivering power to the load.
3. The LINE and SENSOR indicators should be illuminated green before proceeding. The BATTERY indicator will illuminate red before the battery circuit breaker is closed. The BATTERY CIRCUIT BREAKER on the front panel of the power supply may be placed to the ON (1) position only after verifying that the LINE and SENSOR indicators are illuminated green.
4. The BATTERY indicator should change from red to green after the BATTERY CIRCUIT BREAKER is turned ON. Following a short time delay and with AC line voltage within acceptable limits, the BATTERY indicator should change from green to amber. This occurs when the internal battery charger begins delivering a high rate charge to the external batteries. High rate charge will end automatically and is signalled when the BATTERY indicator changes color from amber to green.
5. The power supply is now operating in its normal mode. All indicators on the front panel of the power supply should be illuminated green, perhaps with the exception of the CHARGER indicator which may be amber. Additionally, the TEST indicator should either be extinguished or may flash amber occasionally as the status monitor circuits communicate with the external transponder, if connected.

Front Panel Status Indicators:

Verify the status of the power supply from the LED display during normal operation. All indicator LEDs are located on the front panel of the inverter module.

LINE (AC input /Mains)

- GREEN (nominal AC line voltage/normal operation)
- AMBER (qualifying AC line voltage)
- RED (AC input low or absent)

BATTERY

- GREEN (nominal battery voltage/normal operation)
- AMBER (high rate charge)
- RED (alarm: low voltage cutoff & sleep mode or batteries disconnected)
- RED, Blinking (alarm: batteries incapable of supporting standby operation)

SENSOR (Battery Temperature Sensor)

- GREEN (normal operation)
- Not Illuminated (disconnected or sensor fault)

TEST

- GREEN (test in progress initiated locally)
- AMBER (test initiated remotely)
- AMBER FLASH (data communication)
- RED (last test failed)

Press the TEST pushbutton switch, accessible through the front panel of the power supply to initiate the test function locally. The power supply automatically tests the batteries and internal circuitry for a factory-adjusted time of 5 minutes. Press the TEST switch again to cancel the test at any time.

Backfeed Lockout Indication:

The power supply is equipped with a safety (anti-backfeed) circuit that prevents inverter output from backfeeding the utility lines in case critical components within the power supply fail. If the anti-backfeed circuit is activated, inverter operation is automatically suspended and all front panel indicators, except the SENSOR indicator, flash red. Removing both AC and DC inputs will reset the power supply and cancel the backfeed lockout condition; however, corrective maintenance may be required to repair the basic cause of the lockout condition.

Section 7: Power Supply Shutdown

If power supply shutdown becomes necessary at any time, observe the following procedure:

1. Operate the toggle of the BATTERY CIRCUIT breaker to the OFF position, then disconnect the battery cable from the power supply.
2. Disconnect the line cord from the enclosure receptacle or operate the circuit breaker in the AC service entrance box to the OFF position.
3. If desired, the AC output cable and any accessory cables may be disconnected.

Section 8: Options

The Blackhawk Series power supplies support several optional features appearing in the following list. The options and accessories listed enhance the usefulness of your power supply as aids to installation and servicing and are available through Multilink Broadband as extra-cost items.

Cabinet Indicators:

Power supplies documented in this manual support external alarm lamps mounted in the power supply enclosure which act as a simple form of status monitoring. A red lamp located on the external enclosure will illuminate to indicate operation from battery reserve during a commercial AC power failure, or a failure condition in the batteries or power supply that requires corrective action. Normal operation without any alarm conditions is indicated by illuminating a green lamp only.

Battery Cable Kits:

Designed for 3, 4, 6, or 8-battery powering applications.

Remote Indicator Harness (30 inch):

Designed for use with custom remote indicator systems.

Output Cable:

28-inch unterminated cable adapts the UPS for use in a wide variety of existing enclosures.

Status Monitoring:

The optional HMS Status Monitor may be installed in any Blackhawk Series power supply. This method of status monitoring supports communication between the power supply and an external transponder device via an RS-485 serial port as described in ANSI/SCTE 25-3 2002 (HMS-022) Standard.

An optional HMS-to-Legacy converter may be installed which enables the conversion of serial digital data into analog format. The analog output enables power supply monitoring through the use of older types of status monitor equipment.

Battery Balance Manager:

This accessory, available as a separate assembly, is designed to maintain identical terminal voltage of each 6-cell battery in the string within 130 millivolts (0.130 volt) as measured across the entire battery string. Balancing battery voltages will help maintain battery life to maximum attainable time and helps insure longest available reserve time. The BBM Plus Battery Balance Manager is available for either 36-volt applications (part no. 018-008-20) or 48-volt applications (part no. 018-009-20).

Section 9: Maintenance and Adjustments

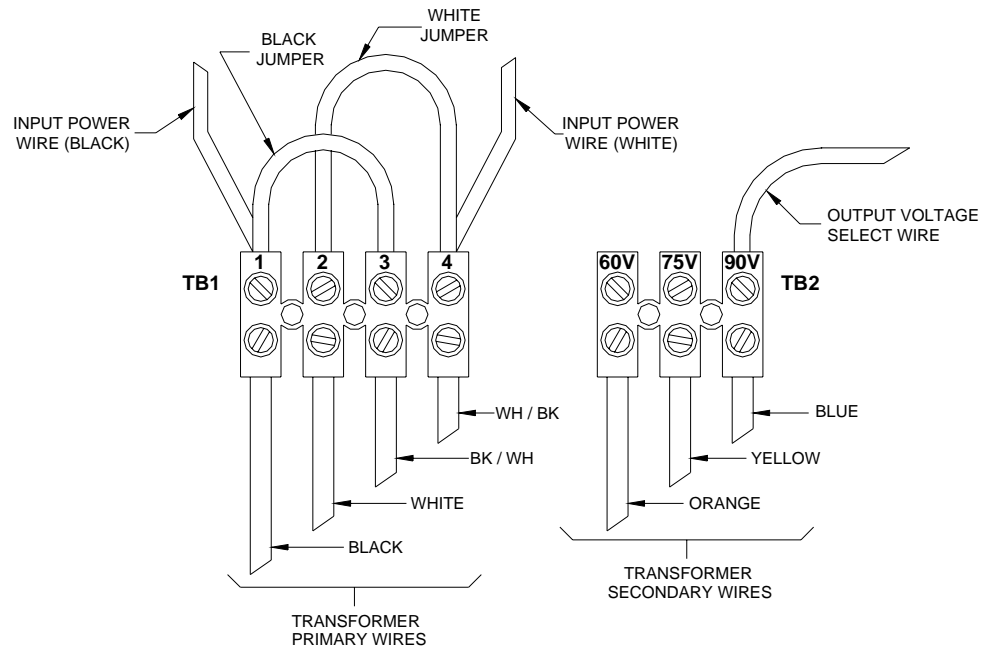
Preventive Maintenance:

For optimum performance from your power supply, the following maintenance items should be performed at least every six (6) months, especially in areas where the power supply is subjected to extreme heat or cold.

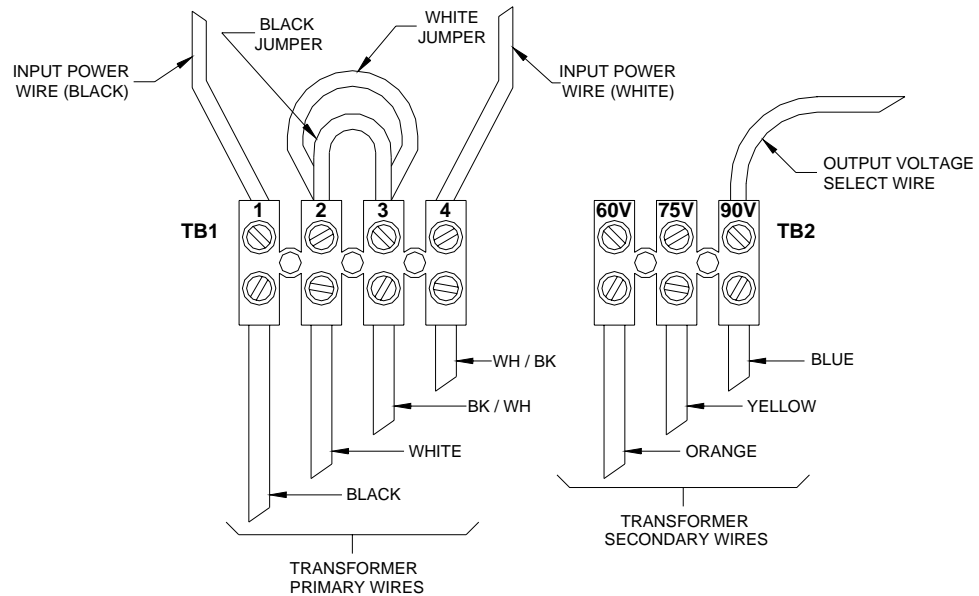
- Visually inspect the enclosure for signs of damage
- Inspect the external status lamps for proper operation
- Check the status LEDs on the front of the power supply for any alarm indications
- Check all electrical connections
- Check the batteries for signs of swelling, split cases or other damage
- Check and record individual battery voltages
- Check and clean battery terminals; bolts or wingnuts must be tight
- Measure and record AC output voltage
- Measure and record AC output current
- Measure and record DC battery voltage
- Press the TEST button on the front panel to test the batteries. Press TEST again to cancel
- Record all maintenance performed or parts replaced
- Verify the power supply is in its normal mode of operation as indicated by the LED display. All front panel LEDs, other than the TEST indicator, should be illuminated green
- Close and lock the enclosure

Output Voltage Reconfiguration:

The output voltage configuration block is located on the voltage adjustment panel, accessible after removal of the left-front cover plate. Typical connections for the voltage adjustment panel are shown in Fig. 9-1. Voltage configuration should normally be accomplished during initial installation of the power supply; however, if reconfiguration becomes necessary after the power supply is placed in operation, do so according to the following procedure.



**Fig. 9-1. Power Supply Voltage Adjustment Panel:
120VAC Input; 90VAC Output**



**Fig. 9-2. Power Supply Voltage Adjustment Panel:
240VAC Input; 90VAC Output**

DANGER

Performing the following procedure exposes the servicing technician to hazardous voltages and will disrupt power to the system loads. The servicing technician **MUST** verify that AC and DC input sources to the power supply have been removed. If system power must be maintained during output voltage reconfiguration, connect the output from a service supply to the power insertion point of the cable before proceeding.

1. Perform Steps 1) and 2) of the shutdown procedure appearing in Section 7) of this manual.
2. If necessary, ensure that power to the cable system is being provided by a service supply. Verify that the AC input cord of the power supply has been disconnected from its receptacle.
3. Disconnect the output cable from the power supply, then remove the left-side front panel. Retain all mounting hardware.
4. Place the output voltage select wire shown in Fig. 9-1 and 9-2 into the appropriate voltage connection terminal of TB2. Select the 60, 75 or 90-volt position as required per system needs. Tighten the terminal board screw to secure the voltage select jumper wire in place.
5. Replace the left-side front panel and fasten into place using the hardware retained from Step 3).
6. Reconnect cables to the power supply and inverter module as required, then restart the power supply according to the procedure contained in Section 6) of this manual. After the power supply has been restarted, remove the service supply to complete this procedure.

Input Voltage Configuration:

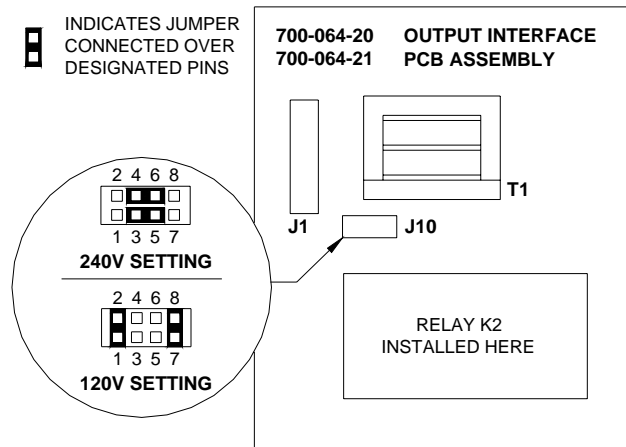
Your power supply has been manufactured, equipped and tested for the input voltage specified on the original order, either 120 or 240 volts AC. Since certain hardware changes and recalibration would be required, reconfiguring the power supply for a different input voltage is not recommended as a field modification. Input voltage reconfigurations, where and when required, should be installed only at qualified service centers or repair facilities.

In emergency situations, where input voltage reconfiguration must be carried out for temporary operations, perform the following procedure:

DANGER

Performing the following procedure exposes the servicing technician to hazardous voltages and will disrupt power to the system loads. The servicing technician *MUST* verify that AC and DC input sources to the power supply have been removed. If system power must be maintained during input voltage reconfiguration, connect the output from a service supply to the power insertion point of the cable before proceeding.

1. Perform Steps 1) and 2) of the shutdown procedure appearing in Section 7) of this manual.
2. If necessary, ensure that power to the cable system is being provided by a service supply. Verify that the AC input cord of the power supply has been disconnected from its receptacle.
3. Disconnect the output cable from the power supply, then remove the left-side front panel. Retain all mounting hardware.
4. Place the input voltage select wires shown in Fig. 9-1 and 9-2 into the appropriate voltage connection terminal of TB1. Select the 120 or 240-volt position as required per system needs. Tighten the terminal board screws to secure the voltage select jumper wire in place.
5. On the power supply output board, locate J10 adjacent to transformer T1. These terminals are configured by two pin jumpers: one position for 120-volt input; the other for 240-volt input. Refer to Fig. 9-3 for a diagram of the required pin jumper positions. Reconfigure the positions as required, for either 120- or 240-volt operation.
6. Locate J5 on the power supply output board. This connector is used for inserting a metal-oxide varistor (MOV) into the power line input circuit for protection against high voltage surges. If configuring the power supply for nominal 240 VAC input, connect a 275 volt MOV (part no. 160-006-10) to J5. If configuring the power supply for nominal 120 volt input, connect a 130 volt MOV (part no. 160-002-10) to J5.
7. When reconfiguration connections have been completed, replace the left-side front panel and fasten into place using the hardware retained from Step 3).
8. Reconnect cables to the power supply and inverter module as required, then restart the power supply according to the procedure contained in Section 6) of this manual. After the power supply has been restarted, remove the service supply to complete this procedure.



**Fig. 9-3. Power Supply Voltage Configuration Jumpers:
J10 on 700-064-20 Output Board**

Battery and Test Time Configuration:

The test time and battery configuration jumpers are located on the trace side of the control circuit board located in the inverter module. The jumpers are factory-adjusted for a test time of approximately 5 minutes. Re-adjustment of test time in the field is neither recommended nor necessary since shorter or longer times may not sufficiently test battery reserve or may use an excessive amount of reserve if a commercial AC line failure occurs during the test cycle.

Battery configuration jumpers have been factory adjusted for 3, 4, 6 or 8-battery installations per customer order. Resetting the pin jumpers for battery configuration is neither recommended nor should it ever be necessary to do so.

Analog Adjustments:

Several miniature potentiometers are located on the printed wiring board of the inverter module. These potentiometers have been factory adjusted for proper charger output voltage and for correct detection and measurement thresholds. Field adjustment of any potentiometer in the inverter module should not be attempted; otherwise, degraded power system performance or damage to the inverter module or batteries may result. If any potentiometer adjustments are suspected as a cause of operational trouble or erroneous

performance reporting, the entire inverter module should be changed in the field. The module with suspected problems should be returned to a service center or the factory for diagnosis and repair.

Troubleshooting:

The troubleshooting guide has been designed to help you quickly locate and resolve common powering problems. If you still cannot solve the problem, replace the inverter module or entire power supply with a known good unit.

CONDITION

No output to load
Batteries connected
AC line power present

CHECK

Output connector plugged in
Battery voltage OK
Output circuit breaker

CONDITION

Incorrect output voltage
Batteries connected
AC line power present

CHECK

OUTPUT select indicator

CONDITION

Batteries will not charge
Batteries connected
AC line power present

CHECK

Battery breaker tripped
Battery terminals and connectors
Battery failure

CONDITION

Batteries not properly charged
Batteries connected
AC line power present

CHECK

Verify connection of battery cable
Verify charger mode at front panel
Measure charge voltage (Rapid, Float)

CONDITION

Front panel test indicators
amber
Batteries connected

CHECK

Remote testing

Batteries not yet fully charged

Section 10: Specifications

Black Hawk 600-120/60-36 or 600-120/60-48

AC Input Voltage	120 volts AC, nominal
Nominal Input Voltage Tolerance	±10% (108-132 volts)
AC Input Current	6 amps, nominal
Input Frequency	60, ± 3 Hz
Line Reject Value	95 VAC, nominal
Line Accept Value	105 VAC, nominal
Power Factor	0.9 typical (line mode operation)
Output Voltage	60 / 75 / 89 VAC selectable taps
Output Voltage Tolerance	+5% and -2% load regulation over input range
Output Current	10 / 8 / 6.7 amps (into resistive load)
Output Power	600 watts
Efficiency (Line Mode)	Better than 90% over line voltage range, at full load
Efficiency (Inverter Mode)	Better than 85% at nominal battery, full load
Run Time (Battery Input)	Greater than 2 hours @ full load with 90A-H battery
DC Input (Battery) Voltage	3-battery system (18-cells): 36V nominal 4-battery system (24-cells): 48V nominal
Low Battery Shutdown	1.75 V/cell (31.5V for 18-cells or 42.0V for 24-cells)
Battery Acceptance Voltage	3-battery system: not less than 28 volts 4-battery system: not less than 38 volts
Battery Charge Current	5 amps @ nominal AC input
Battery Float Voltage	2.27 V/ cell (41.0V for 18-cells or 54.6V for 24-cells)
Temperature Compensation	-0.05V/°F (-0.09V/°C) slope
Protection	DC Input: 80A magnetic/hydraulic circuit breaker AC Output: 20A thermal circuit breaker
Operating Temperature Range	-40°C to +60°C (-40°F to +140°F) At 5% to 95% relative humidity, non-condensing
Size	8.6" H x 15" W x 12.5" D (219 mm x 381 mm x 318 mm)
Weight	xx Lbs. (xx Kg)
Status Monitoring Options	StatTrak (HMS protocol) HMS-to-Legacy converter allowing analog status monitoring

Specifications (cont'd)

Black Hawk 900-120/60-36; 900-120/60-48; 900-240/60-36; 900-240/60-48

AC Input Voltage	120 volts or 240 volts AC, nominal
Nominal Input Voltage Tolerance	±10% (108-132 volts or 216-264 volts)
AC Input Current	10 amps @ 120V input or 5 amps @ 240V input, nominal
Input Frequency	60, ± 3 Hz
Line Reject Value	95V @ 120V input or 192V @ 240V input
Line Accept Value	105V @ 120V input or 210V @ 240V input
Power Factor	0.9 typical (line mode operation)
Output Voltage	60 / 75 / 89 VAC selectable taps
Output Voltage Tolerance	+5% and -2% load regulation over input range
Output Current	15 / 12 / 10 amps (into resistive load)
Output Power	900 watts
Efficiency (Line Mode)	Better than 90% over line voltage range, at full load
Efficiency (Inverter Mode)	Better than 85% at nominal battery, full load
Run Time (Battery Input)	Greater than 2 hours @ full load with 90A-H battery
DC Input (Battery) Voltage	3-battery system (18-cells): 36 V nominal 4-battery system (24-cells): 48 V nominal
Low Battery Shutdown	1.75 V/cell (31.5V for 18-cells or 42.0V for 24-cells)
Battery Acceptance Voltage	3-battery system: not less than 28 volts 4-battery system: not less than 38 volts
Battery Charge Current	5 amps @ nominal AC input
Battery Float Voltage	2.27 V/ cell (41.0V for 18-cells or 54.6V for 24-cells)
Temperature Compensation	-0.05V/°F (-0.09V/°C) slope
Protection	DC Input: 80A magnetic/hydraulic circuit breaker AC Output: 20A thermal circuit breaker
Operating Temperature Range	-40°C to +60°C (-40°F to +140°F) At 5% to 95% relative humidity, non-condensing
Size	8.6" H x 15" W x 12.5" D (219 mm x 381 mm x 318 mm)
Weight	xx Lbs. (xx Kg)
Status Monitoring Options	StatTrak (HMS protocol) HMS-to-Legacy converter allowing analog status monitoring

Specifications (cont'd)

Black Hawk 1350-120/60-36; 1350-120/60-48; 1350-240/60-36; 1350-240/60-48

AC Input Voltage	120 volts or 240 volts AC, nominal
Nominal Input Voltage Tolerance	±10% (108-132 volts or 216-264 volts)
AC Input Current	14 amps @ 120V input or 7 amps @ 240V input, nominal
Input Frequency	60, ± 3 Hz
Line Reject Value	95V @ 120V input or 192V @ 240V input
Line Accept Value	105V @ 120V input or 210V @ 240V input
Power Factor	0.9 typical (line mode operation)
Output Voltage	60 / 75 / 89 VAC selectable taps
Output Voltage Tolerance	+5% and -2% load regulation over input range
Output Current	22.5 / 18 / 15 amps (into resistive load)
Output Power	1350 watts
Efficiency (Line Mode)	Better than 90% over line voltage range, at full load
Efficiency (Inverter Mode)	Better than 85% at nominal battery, full load
Run Time (Battery Input)	Greater than 2 hours @ full load with 90A-H battery
DC Input (Battery) Voltage	3-battery system (18-cells): 36 V nominal 4-battery system (24-cells): 48 V nominal
Low Battery Shutdown	1.75 V/cell (31.5V for 18-cells or 42.0V for 24-cells)
Battery Acceptance Voltage	3-battery system: not less than 28 volts 4-battery system: not less than 38 volts
Battery Charge Current	5 amps @ nominal AC input
Battery Float Voltage	2.27 V/ cell (41.0V for 18-cells or 54.6V for 24-cells)
Temperature Compensation	-0.05V/°F (-0.09V/°C) slope
Protection	DC Input: 80A magnetic/hydraulic circuit breaker AC Output: 20A thermal circuit breaker
Operating Temperature Range	-40°C to +60°C (-40°F to +140°F) at 5% to 95% relative humidity, non-condensing
Size	8.6" H x 15" W x 12.5" D (219 mm x 381 mm x 318 mm)
Weight	xx Lbs. (xx Kg)
Status Monitoring Options	StatTrak (HMS protocol) HMS-to-Legacy converter allowing analog status monitoring

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